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THE TEA RESEARCH INSTITUTE  
St. Coombs, Talawakelle.



# The Tea Research Institute of Ceylon.

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## NOTE.

The Laboratories of the Institute are situated at St. Coombs Estate, Talawakelle, and letters and enquiries should be addressed to the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle. Telegraphic Address :—Research, Talawakelle ; Telephone, Talawakelle 44 (Private Exchange). It is particularly requested that letters should not be addressed to officers by name.



## PROCEEDINGS OF THE T. R. I. CONFERENCE

The Seventh Conference of the Tea Research Institute was held at Radella Club on Wednesday, February 26th, 1947. Mr. R. Singleton-Salmon, Chairman of the Planters' Association and Acting Chairman of the Tea Research Institute, presided. 300 visitors were present.

### ADDRESS BY THE CHAIRMAN MR. R. SINGLETON-SALMON

Before opening this Conference, the Seventh to be held by the Institute, I would like to extend to all of you, who have come here to help make it a success, a very hearty welcome. It is a very real and practical demonstration of the interest that is being taken in the work of the Institute, and I sincerely hope that now we have been able to start holding these Conferences again, we shall continue. I also hope that at not-too-distant a date we shall be able to renew the Sub-Conferences that were started in 1940 as a result of suggestions made at the previous Conference.

We are indebted to the Chairman and Committee of the D. A. C. C. for so kindly placing at our disposal the facilities of their club house for this Conference, and for making other arrangements for our welfare today. I observe that in the Notice of the Conference, it is stated that "Drinks will be available in limited supply." I do not know how limited that supply will be but, if the worst comes to the worst, one can always fall back on a cup of tea! I would like to place on record our thanks to the Chairman and his Committee for these amenities.

In his Address at the opening of the Sixth Conference, the Chairman, Mr. James Forbes (Jnr.) dwelt at some length on the

finances of the Tea Research Institute. It is an unhappy coincidence that at the time the Seventh Conference is held, finance is again causing the Board of the T. R. I. much concern.

The tea cess for research, fixed in 1931 at 14 cents per 100 lbs. of tea exported, is one of the very few items that has not gone up by leaps and bounds during the war. In actual practice this cess had been found sufficient to cover expenditure and, indeed, to add to reserves. This fact had, however, only masked the real financial position of the Institute, for, during the war, part of the salaries of some officers had been paid by the units with which they served; and it had not been possible to carry out essential services of a capital nature. Renewals, replacements and the purchase of new machinery and laboratory equipment had not been possible. What was happening, therefore, was that although the cess of 14 cents per 100 lbs. of tea exported appeared to be covering our commitments, it was only doing so because the expenditure had been considerably below what it would have been if we had had a full complement of officers, and if we had been able to carry on with normal capital expenditure.

With the return to more normal conditions of working the Tea Research Institute, we find that the cess of 14 cents will barely cover recurrent expenditure, and that all expenditure of a capital nature, including the repayment of the loan to Government, will have to come out of Reserve. This reserve is totally inadequate to stand the strain, and we are appealing to Government to increase the cess by 50%, i.e. from 14 cents per 100 lbs. to 21 cents per 100 lbs. That



increase would mean that, instead of a total export duty of 38.15 cents per lb. there would be a total export duty of 38.22 cents per lb !

As you are all probably aware, the Board has approved, in principle, the establishment of a Research Station for the Low-country. It has also laid down that the first step towards the fulfilment of that principle must, of necessity, be the recruitment of a full complement of officers at St. Coombs, and the recruitment and training of the required technical assistants. These Assistants will have to be housed, and we are going ahead with the provision of suitable quarters for them. This all requires money, and, unless the financial future of the Institute is assured, it will be impossible to carry out the work of the Institute in a manner worthy of the main agricultural industry of the Island.

And now I would like to say a few words about the Conference itself.

The main object of this Conference, to my mind, is to bring up-to-date those members of our profession who have been absent on war duties during the past several years, and, with this object in view, the papers that will be submitted by officers of the Institute will be a review of the work of their respective departments during the past few years.

There is one exception, the paper to be submitted to you by Dr. Tubbs on "Blister Blight." This blight did not add to the horrors of war but it has added to the complications of peace !

As you will have seen, from the programme, there is a definite time limit set for each paper and discussion, which will allow of approximately 20 minutes for the paper and 25 minutes for the discussion on that paper. I am sure you will agree that unless there is to be chaos, we must adhere to that time-table.

In order that as many as possible may present their views, I would appeal to all speakers to make their observations in as few words as may be consistent with clarity. I would also appeal to those who may be diffident about asking questions, or expressing views, to remember that we are all here to learn something—that not even the most omnipotent of V. A's or the most erudite of scientists knows all the answers to all the questions.

Having appealed for brevity in speech, it would be inconsistent if I continued to monopolise the time of this Conference any longer. I will, therefore, now call upon Dr. Gadd, the Acting Director, to give us his resume of "The Institute During the War Years."



## THE INSTITUTE DURING THE WAR YEARS

DR. C. H. GADD

Acting Director

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Since our last Conference in February, 1939 so much has happened that it is yet impossible to evaluate its full effect on our lives, our future or our Industry. One outcome of the war has been a revival of interest in Science, which though it has been harnessed to the powers of destruction has done, and can do much for the benefit of mankind. The need for scientific investigation and scientific planning for the future is undoubted. Science is not all spectacular, in fact very little of it is. Yet to the majority, mention of Science calls to mind Radar, Atomic Bombs, speedier travel and such like things. The agricultural scientist's achievements do not appeal to the imagination in that way, and he can show no such spectacular results; nor are any such likely in the near future.

Industrialisation has become an even more important subject for planners. One hears little about agriculturalisation (if there is such a word), and movement is still from the land to the towns and never in the reverse direction. Yet agriculture is the basic, fundamental industry on which the whole world depends, and in the future it is sure to make demands for greater assistance from Science.

The existence of the Tea Research Institute is evidence of a belief that science can help the Tea Industry, and the attendance at this Conference is proof of the interest in its work. It should not be forgotten however that nature never discloses her secrets readily, and that long and pati-

ent effort is necessary to reveal them. During the war years, while many of you were away doing a greater work, the Institute was steadily plodding on. Since your return, enquiries and requests for discussions with the Staff, though gratifying, have proved somewhat embarrassing as so much of the Staff's time was being consumed in that way. Today's conference has been arranged to afford an opportunity for a general discussion of the Institute's work during the war years.

It is not my intention at this stage to review, however briefly, that work. That I shall leave to individual officers who will talk about some of the work of their own divisions. In their papers they will touch upon some of the main problems under investigation and not give a more detailed exposition of one problem as has been usual at other Conferences. Our object is to afford a background for more detailed study of our published reports and to widen the scope of discussion which I hope will follow the papers. Each paper will be limited to about 15 to 20 minutes and so allow time for general discussion\* and questions afterwards. This afternoon, the final half hour of the session has been set aside for general discussion, and if discussion has been cut short after any paper it may then be continued and other subjects raised, if necessary.

Before the war, in addition to the Director and the Superintendent of the Estate there were five senior members of



the Scientific Staff, each in charge of a division. Dr. Tubbs was at Home at the outbreak of the war and was called to the Colours. He served throughout the war and is now back with us, somewhat loaded with Honours, to make two tea leaves grow where only one grew before. Mr. King, the Entomologist, proceeded on active service in February 1941, but unfortunately he has not rejoined the Staff owing to ill-health. Mr. Lamb was away during 1942 and 1943 on special service for which his scientific attainments particularly qualified him. The absence of three Senior Officers was a heavy handicap. Nevertheless research work in all divisions was carried on. Against that loss there was the addition of one officer, Dr. Bond specially recruited to study the disease known as *Phloem necrosis*. His resignation to take up another appointment at Home is a loss to the Institute.

The work in any Division depends not only upon the senior officer but upon the number and efficiency of the junior staff as well. As N.C.O's are said to be the backbone of the army, so are the junior technical officers the back-bone of research. Our loss amongst the junior staff was not great, and in that respect we were fortunate. I should here like to pay tribute to the loyal service of the whole staff during those difficult and worrying times.

The shortage of senior officers was not the only handicap. As the war progressed, equipment and chemicals became increasingly difficult to obtain. But it is not my

purpose to emphasise our difficulties; it is sufficient to mention that many existed.

There seems no end to the problems which might occupy the attention of each Division, but very few can be seriously tackled at a time. Some form of selection has to be used. So if your own particular problem appears to be neglected and is not mentioned during the conference, it does not mean that it has been lost sight of, nor that it is regarded as unimportant. A question may elicit some of the information you need. But please don't think that we know all the answers. If we did, there would be no need for research.

Now a word about the future. At present we are attempting to run a pre-war establishment under post-war conditions on a pre-war income. We know from domestic experience of post-war costs that that cannot be done. The cost of research has increased like everything else. Moreover difficulty is being experienced in replacing senior officers as there is a world shortage of scientists, so the Institute is likely to be understaffed for some time. Post-war conditions are likely to bring new and more complex problems demanding increased research. If the Institute is to grow, or even to maintain its present standard of efficiency, an increased income is essential as our Chairman has told you. On that subject I need say no more. Our work today is to review the work of the Institute during the War Years and to indicate some of the present day problems.



## MANURIAL RESPONSES OF TEA AND WEEDS

T. EDEN

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The fact that for four years we have been subject to rationing of fertilizers, has accentuated the interest that has always been shown in the question of fertilizer responses. Consequently, it has seemed to me that on this occasion it would be profitable to speak mainly of the additional information that has been accumulated since these conferences were suspended.

We now have a firmer knowledge of this subject because of our longer experience. Our oldest experiment is now in its sixteenth year and the consistent results it has given are obviously no mere flash in the pan. I may therefore usefully start by refreshing your memories of the broad results of our manurial experiments at the time of our last gathering.

At that time, nitrogenous manures showed the greatest response. Furthermore, they showed that within the range of doses used, the response was strictly proportional to the dose. That finding has been consistently confirmed and the range of dose has been extended up to a higher limit of 80 lb. of nitrogen per acre. Even at this relatively high figure the law of diminishing returns has shown no signs of operating. I have frequently been asked during the rationing period, when quotas were substantially lowered, whether it was worth while to apply these reduced quantities. The experiments have given a clear cut answer in the affirmative.

Further evidence is now available on the subject of the relative efficiency of doses given at different periods in the pruning

cycle. I have been studying old records, and it is clear that when the Tea Research Institute was founded, any sort of system about the size of applications was conspicuous by its absence. For one thing, very many people were obsessed by the idea that 600 lb. of manure was better than 500 lb. without any regard to its composition. As you are now well aware, during rationing we have had many changes in the bulk relationships of manure supplies without a corresponding change in nutrient quantity. Mere bulk signifies nothing. Speaking broadly, twenty years ago fairly uniform applications were used at the annual periods in the pruning cycle.

Now in ordinary estate practice it is never possible to assess the efficiency of fertilizers by a mere inspection of crop records, because there is no adequate control. The effect of a manure can never be assessed by dividing the total crop by the pounds of nutrient supplied. Systematic experiments allow us to measure the real response with accuracy, and the results of the past few years have been instructive. The efficiency of nitrogen increases as the pruning cycle proceeds, provided that the last dose is applied sufficiently long before pruning for the manure to exert its full effect. The averages for the past 15 years show that under our conditions we can expect one pound of tea per lb. of nitrogen applied near to the time of pruning, four pounds from the second year dose, and five from the third application in a 3-year cycle. These figures if plotted in a graph show a distinct bend in the curve. On other



experiments that bend is not so pronounced and may not appear at all. What is common to all our experiments is that the efficiency mounts continuously, though not necessarily uniformly, as the cycle progresses. This is the factual basis for incremental doses of manuring. It is also the explanation of why, when manure was at its scarcest, I recommended that first-year fields could advantageously be sacrificed.

These results raise the question of how far this increase in efficiency can go. Steady manuring of our experiments with invariable quantities from year to year has raised our maximum efficiency from about 4 to 6 lb. of crop per lb. of nitrogen. There are indications that the latter figure is somewhere near the maximum. It corresponds very closely to the related figure obtained in Assam.

There are two qualifications to be added to this exposition. I have been referring to mature tea with a somewhat sparse shade. We have an experiment on young tea with an excellent cover of *Grevillea* which, so far, has not shown any response to more than 30 lb. of nitrogen per acre. Whether it is age or shade that is the operative factor I cannot say, but, be that as it may, this experiment confirms my opinion that young tea is frequently wastefully manured.

The second reservation is concerned with the climate in Uva and similar districts. On our parallel experiments there, the efficiency of nitrogen has never exceeded a figure of 3. In fact it is only on the longer pruning cycles that this value is reached. We now know that shot-hole borer damage is in part responsible for this but the picture is not entirely clear and we must seek information about the effect of

the annually recurrent drought with its effect of restricting both growth periods and suitable times of manurial application.

Turning to phosphatic manuring, the picture is different. The law of diminishing returns operates there very thoroughly. High phosphatic doses of 60 lb. phosphoric acid were once the vogue. They pay no dividends, and in our experience are not superior to doses half that size. The optimal dose may be even smaller, and we are now exploring the lower range, below 30 lb. per acre.

The importance of regulating the phosphatic dose has been forcibly demonstrated by experiments showing what a prodigious effect phosphates have on the weed flora. When plots were left unweeded for 3½ months the weight of weeds removed from the phosphatic plots was 2½ times as great as it was from those which for two cycles had been devoid of phosphate. Here again the increase from 30 lb. to 60 lb. per acre of the nutrient was ineffective so the figures act as useful confirmatory evidence of the tea results. Such rank weed growth is not only a nuisance in itself but, in the prevalent system of clean weeding, or would-be clean weeding, involves an appreciable loss of nutrient. Removal of those weeds involved a loss of valuable nutrient to the following extent:—

	lb. per acre
Nitrogen	11
Phosphoric Acid	5
Potash	21

It is of special interest to note that the amount of phosphates wasted is not severe. That is because the phosphate content of weeds is small. I will not go so far as to say that by multiplying these figures by 3 we can get an accurate figure for the removal of nutrients by weeds over



a year's space of time, but the position as regards nitrogen and potash is disturbing. At a conservative estimate, weeds are removing half as much nitrogen as that taken off by the tea crop at its most productive period; an equal amount of phosphate; and twice as much potash. I must leave the broader question of weeds as a whole for another occasion, but this is a new and important aspect of the problem.

I have just related the toll on potash supplies that weeds can make. Until quite recently potash showed no signs of giving a response on mature tea. All that happened with increased doses of potash was that the plant tissues were enriched, but no yield increments were visible. Tea was in fact a mere luxury consumer of added potash. This state of affairs held good over the first twelve years of the experiment, but in the last cycle deterioration set in on the no-potash plots. During this cycle we have lost 60 lb. per acre by reason of potash deficiency. The type of response is similar to that for phosphate. Doses of 20 lb. give an increase of crop, or if you like, maintain a normal yield: doses of 40 lb. bring no added benefit.

I have always borne in mind the fact that we were removing about  $2\frac{1}{2}$  lb. of potash for every 100 pounds of crop. Now there is the weed effect to contend with as well. When manurial supplies are freely available, it will be well to reconsider the adequacy of potash manuring in the light of these results.

There is one further aspect of the potash question. Some years ago the Tocklai Station published an experiment showing the beneficial results on the growth of young tea obtained by very generous potash manuring before it was brought into

bearing. Like ourselves they had had no such effects on old tea. Such an effect is surprising, and my only contribution to the problem so far is that in a similar experiment on our young tea we have not confirmed their beneficial results.

## DISCUSSION

The discussion that followed revolved round three main points; (1) the competition for nutrients between weeds or cover crops and tea; (2) the general question of weed control; (3) the efficiency of tea as a user of nutrients at different stages of growth.

*Weed Competition.*—Questions were asked about the competitive effect of *Vigna* in comparison with weeds, and on the demerits of individual species of weeds in exploiting manurial applications. Dr. Eden indicated that the chief disadvantage of *Vigna* was its climbing habit, and not its competitive absorption of nutrient. Being a leguminous plant, with nitrogen-fixing nodules it made a positive contribution to the crop environment and its demands were accordingly less severe than those of weeds. No clear distinction could be made between the various individual species of weeds. Such distinction would require much detailed analytical work. As a class, grasses were more avid for nitrogen than broad-leaved weeds, and left little available nitrogen in the soil for their competitors. Whilst this characteristic was beneficial in crop rotations in which grass leys stored nitrogen for release to arable annual crops later, it was an unfavourable factor in a perennial such as tea. The storage of nutrients by weeds was particularly noticeable in the instances of phosphate and potash. Even when not contributing to increased growth, manures were capable of increasing the concentration of the nutrient concerned



in the tissues of the weed thereby increasing the loss occasioned by clean-weeding manured tea.

This explanation raised the further enquiry of how best to dispose of weeds so as to avoid these losses; in particular whether composting involved appreciable loss. To this the reply was given that when weeds decomposed in the soil there was no appreciable loss. Composting was always accompanied by some loss. The Institute was experimenting with a system of weed-control based on leaving weeds for 3-6 months and then removing and burying them in pits. The experiment had not yet proceeded far enough to give results.

To an enquiry whether depth of cultivation had any effect on absorption of fertilizers by weeds. Dr. Eden answered that since weed root-systems were shallower than those of tea it was advantageous to fork deeply when incorporating manures.

**Weed Control.**—Questions about general control of weeds centred round artificial methods of killing them. It was pointed out that chemical weed killers such as had been successful with cereal crops in temperate lands worked at a disadvantage in local circumstances. Weeds and cereals grew at approximately the same pace, and when the broad-leaved weeds were scotched by chemical weed-killers early in the season, the main crop was enabled to grow rapidly and smother any attempts at renewed growth. With tea, the rate of growth was much slower than that of weeds. Annual weeds were much more vulnerable than perennial ones. Further, rotation of crops helped farmers in temperate climates to check weed growth. With a perennial crop we had not this advantage.

The use of chemical weed-killers raised the question whether inorganic manures were less favourable to weed growth than organic. Our experiments had shown no difference between the two though, under suitable weather conditions, sulphate of ammonia might have a scorching effect on weeds which would give a very temporary check. On the subject of destruction of weeds *in situ* by flame-throwing apparatus Dr. Eden had no information relevant to Ceylon. Such work was not done in the presence of a standing crop, and the only implement he had seen that might be used in tea rows was in his opinion dangerous to the tea.

Shade and consequent competition for light and root space was a good deterrent and that explained the observation that weeds were less troublesome under Albizias.

**Nutrition of Tea.**—The section of the lecture dealing with efficiency of the tea bush as a user of nitrogen led to a discussion on the effect of maturity of the foliage on nutrient synthesis. The phrase immature leaf was used in connection with plucking standards, and had no special physiological meaning. Fine distinctions were not possible, but on the whole the older leaves were less efficient elaborators of food than the young. When asked to reconcile this with the previous declaration that the efficiency of a bush increased with age from pruning Dr. Eden said that age of leaf was only one factor. The over-riding factors in bush efficiency were the number of leaves and the vigour and extent of the root system. Though plucking removed the young synthetically active leaf, there was more leaf left to carry on the process at the end of a cycle than at the beginning.



To the question whether young tea required more phosphate than nitrogen, the reply was that our experiments did not suggest that young tea had different requirements from old tea. They did suggest that much young tea was over-manured.

In reply to a question concerning the effect of inorganic manures such as sulphate of ammonia on the natural balance of soil organisms, particularly parasitic eelworms like the meadow eelworms, Dr. Gadd said that the soil population was very complex consisting of many different kinds of

organisms such as bacteria, fungi, insects, eelworms and others, and that any soil treatment was likely to upset the natural balance temporarily. Sulphate of ammonia tended to make soils more acid and its repeated use would favour these organisms preferring more acid conditions. It was very unlikely however that the small change in soil acidity resulting from the use of sulphate of ammonia would have any material effect on the eelworm population. The meadow eelworm lived mainly within roots and in that position would be even less affected by any small change in soil acidity than other organisms living free in the soil,

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## BLISTER BLIGHT

F. R. TUBBS

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Blister Blight is the appropriate name given to a leaf disease caused by the fungus *Exobasidium vexans*, which is a recent and unwelcome arrival in Ceylon and South India. This particular disease of tea has been known in North India for nearly ninety years. It is necessary, therefore, to preface my remarks today with the clear warning that we must be very cautious in the use of the Indian reports. Neither you, nor I, can define with real exactitude the similarities and dissimilarities in climatic and other conditions between the two countries in so far as they affect the growth of a particular fungus. It is important, therefore, that we should study the behaviour of the disease in Ceylon, rather than reports of its behaviour in other countries under possibly very different circumstances. A natural corollary is that the present paper, delivered

four months after the first report of the disease in Ceylon, should not be regarded as final.

Reports of the occurrence of blister Blight in Ceylon before 1945 must, I think, be discounted. The first occasion on which the disease was identified was at the end of October 1946, at an elevation of 2,500 feet in Dolosbage. In the ensuing three weeks reports came in from five other Western planting districts, mainly at higher elevations. Subsequently, additional centres were reported from each affected district. The "incubation period" of the disease is long enough for it to be likely that the early isolated outbreaks were distinct from, and not a result of, the reported outbreak at Dolosbage. In discussing the subsequent course of the disease I prefer to use the word "occurrence"



rather than "spread." It should be noted that we have no evidence whatever as to the real source of the spores originating the subsequent outbreaks.

New outbreaks occurred more and more frequently from November 1946 until the beginning of January 1947, when a decline set in. The elevational range increased, until it was known above 6,500 feet, and below 500 feet. The greatest number of reports have come from elevations of about 4,000 feet, but it must be remembered that the greatest number of large estates occur at this elevation. If the planting districts as set out in Ferguson's Ceylon Directory are considered, only four districts (Dumbara, Galle, Matara and Weligama, Moneragala) (20th February) have not reported the disease. It is noteworthy that it appeared in Uva during the prevalence of north-easterly winds.

The economic effects of the arrival of the disease are difficult to assess. Every new disease is a threat to the industry. But there are, fortunately, only a few estates that claim to have lost much crop additional to the loss that would have resulted, in any case, from the adverse climatic conditions at the time. In this we can reckon ourselves fortunate, for there can be no question that the disease can inflict very serious damage if severe attacks recur in fields recovering from pruning.

Some understanding of the relationship between host, parasite, and environment is essential for the proper assessment of possible control measures. The fungus has only been grown upon living tea leaves and stems. No other host is known in Ceylon. The airborne spores, produced in vast numbers, undoubtedly perish in vast numbers. But under suitable conditions a proportion

alight upon tea leaves and germinate there, normally on the under-surface. The germinating spore produces a hypha which enters the leaf tissue and ramifies there. After about ten days, a small yellowish green translucent spot is produced. Some substance produced by the fungus causes local growth of the host, with the result that a circular crinkle, or blister, is produced. About a week or so later the fungal hyphae burst through the cuticle on the under-side of the leaf and very numerous spores are formed. It is this process which gives the white, doughlike appearance to the blisters. The spores are carried away by the wind and, if conditions are favourable, a vast increase in infections results; it is the same phenomenon, in fact, as Dr. Gadd has already described to you in relation to insects, but with possibly even vaster potentialities.

As in the study of insect pests, the host as well as the parasite must be considered. From the accumulated experience in Ceylon it appears safe to say :—

- (a) Young tissues are far more susceptible than old.
- (b) Young leaves are the most frequently attacked, but the damage done is greatest when the young stem is infected, causing the distal portion to die.
- (c) Bushes vary considerably in their liability to the disease and there are, as to be expected, already indications of clonal variations in this respect. Low jat, *under equivalent conditions*, is often said to be more resistant than high, but no generalisation can be made. For example, clones 26 and 1294, low jat types, appear more susceptible than clone 25 so far.



- (d) The amount of damage done depends on the proportion of young to mature growth. Liability is therefore greatest after pruning, especially after severe pruning.
- (e) At elevations below 3,000 feet, the value of lung pruning is enhanced because of the danger of losing the primary tipping shoots.
- (f) Last but not least there is, most fortunately for us, something that limits the growth of the fungus within the bush. Whether it be some process of auto-intoxication, or the production of some compound unfavourable to its growth, the fact remains that the fungus is strictly confined. It is interesting that the development time of the blister increases with the age of the leaf.

We now pass from parasite and host to the influence of external conditions upon their relationship. It is now commonly accepted that dry weather is prejudicial to the disease and wet weather favourable, as in North India. It is important to remember, however, that the fungus is quite uninterested in *our* conception of weather. The spores are produced and ripen in a micro-climate in which temperature, humidity, etc., are quite different from those obtaining even a fraction of an inch away from the leaf. Only when airborne, does the spore come into contact with conditions nearer our conception of the prevailing "climate." But as soon as it alights, if it is fortunate enough to do so, on the under-surface of a young leaf, it attains once more the conditions of its original birthplace. On germination and entry into the leaf, it becomes safe from the vagaries of the climate and also, be it noted, from our hos-

tile acts, until the fruiting stage is reached once again.

A few moments' consideration of this outline of our knowledge of the disease will convince everyone that there are strict limitations upon the control measures that can be taken if they are to be economically justifiable. Naturally that standard is not a hard and fast one — the worse the disease the further one is prepared to go to fight it.

Spraying is the first method of control that springs to mind. But any one who has sprayed the fruit trees at home knows that it is an easier thing to advise than to do. Consider, too, that the spray will only protect existing leaves, and that much of the labour of spraying will go to protect leaves already relatively resistant by virtue of greater age. Consider again that to be effective, not one spraying, but many will be necessary. And even as you spray new leaves will unfold, and new airborne spores arrive to infect them. Remember we have had drastic evidence that infection may arrive from afar and spread very quickly. But if the fungus were to be found to be dependent on, say, a particular period of favourable conditions to enable it to spread, and if this period were predictable in advance, spraying of bearing tea might be desirable. Experience may force us to spray tea recovering from pruning to enable it to retain the leaf surface essential to recovery. But it must be remembered that spraying after an attack has become severe is partly wasted, owing to the large number of invisible infections safe within the host tissues.

. In contrast, the spraying of nurseries is desirable since spraying can be repeated cheaply, and the danger of taints does not arise. If spraying is delayed until the fungus is visible, then you must expect further



infections to show themselves, perhaps in great numbers, during the ensuing twenty days. Spraying is advisable once towards the end of the dry weather and then, subject to experience, once a week during fair periods. It is essential, it may be noted, to wet the under-surfaces of the leaves, a small handspray with a fine jet being sufficient for the purpose.

Picking affected leaves is, of course, an easy and widely used method of control but even here its practical limitations must be recognised. It is only feasible and only effective as a palliative when attacks are relatively light.

I have already suggested that Blister Blight makes heavy pruning of any sort an even more obnoxious practice than it is already. The presence of the disease renders the practice distinctly risky, until we know whether the replacement shoots will survive the disease long enough to obtain immunity with increasing age. Far greater insistence on preserving the spread of the frame, possibly reinforced by lighter pruning and retention of more "points" on the bush, will be necessary if assurance is to be obtained against the obvious risk of loss of frame subsequent to death of tipping shoots. The bush being most vulnerable in the recovery period, it may prove desirable in the districts receiving the S.W. Monsoon to prune so that the tea is shooting by the end of December or early January, so that during February and March some leaves may mature and pass the period of extreme susceptibility. In addition, if the disease proves to be a serious factor in the future cultivation of tea in Ceylon, particularly in the early part of the cycle, then our present conceptions of the best, length of cycle for a particular field or estate will have to be recast in the light of experience in the new conditions.

In so far as shade protects the fungus during the vulnerable periods, it is frequently desirable, where the shade is heavy, to reduce it temporarily by lopping. But any programme of hasty cutting out is to be deprecated. The presence of shade is of little importance on a sunless, misty day of high humidity. It is probably most likely to aid the fungus during periods of intermittent sunlight, and during the transition to and from the dry weather period.

It appears that the fungus is subject in nature to a very delicate balance of favourable and unfavourable factors. For example, through the co-operation of a number of those estates which reported attacks in October and November, details were obtained of the weather conditions during the infection period. In spite of the fact that some estates suffered badly while others had few bushes affected, no consistent differences in the macro-climate were observable. The only evidence obtainable was that heavy rainfall did not prevent the spread of the disease, though it is unknown whether it reduced its severity.

That small differences in local environment can exercise a most striking effect is illustrated by data from plots at Passara. These plots are situated on a slope rising from the banks of a nearby stream. The plots nearest the stream suffered more severely than others only a few feet higher and further from the stream. This phenomenon can be generally observed in hollows and such like places. It is well known that such localities fill, every evening, with saturated air in which condensation of water occurs as the temperature falls, and it is possible that the occurrence of saturated air, or genuine mist formation, over a period exceeding twelve hours may be of importance. Indirectly, also, aspect may have an effect, since early sun considerably



reduces the wet period. As you know cool, damp spots of air may be found in hollows in the lee of jungle belts relatively late in the morning.

It is recommended that each estate commence the deliberate accumulation of data upon the *local* distribution of the disease, both geographically and seasonally. For example, if you have noted that the disease in a given field has been more abundant in a certain hollow, protected by trees from the early sun and heavy shade, it should be noted in a log. If it is found to recur there with severity, it will be necessary to attempt to change the local climate by, say, cutting out the trees. It is suggested that a monthly record be made of the spots in each field in which the disease is worst, provided such spots are made permanently identifiable; action taken should also

be recorded for future information and guidance, together with the results obtained.

To predict the future course of this disease would be foolhardy. To the pessimist I would point out that both North and South India take a calmer view of its potentialities than they did earlier, and that we in Ceylon can congratulate ourselves for the moment on the relatively mild nature of the disease so far. To the optimist I would say that we cannot say we are out of the wood until we know what the disease will do in the South-West Monsoon. To all, I must emphasize that, for the present at least, Man is not the deciding factor in the disease, but Nature. When we know more of all the factors engaged, we may be able to influence the balance. To aid in that, we desire your continued assistance.

## DISCUSSION

A lengthy discussion followed, during which the following statements were made, mainly by Dr. Tubbs in reply to questions.

There was no connection between peach leaf curl and blister blight of tea although there might be certain resemblances. Peach leaf curl was caused by a species of *Taphrina* (*Exoascus*) whereas the fungus that caused blister blight was *Exobasidium vexans*. The latter fungus was not known to occur on any other host than tea, though related but different species had been found on rhododendron in Ceylon. How the fungus arrived in Ceylon was unknown, but it reached there shortly after being first reported in South India. It seemed unlikely that tea seed was the source of infection, as its import

into Ceylon had been prohibited for many years as a precaution against introducing that particular fungus with the seed. South India had also remained free from this disease until last year, although there was no prohibition against import of seed from Assam.

The blister became infectious as soon as the cuticle on the lower side of the leaf ruptured to disclose the white fungus beneath. How long the spores might remain viable on the surface of a leaf during an Uva drought was unknown, but the spores were reputed to be short-lived. The question might be only of academic importance as, allowing that the drought killed all the spores, there would still be risk of reinfection from elsewhere, as happened last year.



Young leaves were undoubtedly the most susceptible, but with increasing age the leaves became more resistant and less liable to infection. For that reason blister blight had in general been worst in recently pruned fields. Yet, recently pruned fields were not all severely attacked. The severity of attack depended to a large extent upon local conditions and it was not always possible to explain why certain fields were more severely attacked than others. The relatively severe outbreak of the disease on 2-year-old tea growing on the top of a ridge where there was very little shade, as reported by Mr. G. E. D. Foster, was somewhat unusual and could not, in the light of present knowledge, be explained, unless the area was subject to mists.

Late tipping was not recommended as it left a large quantity of infectable material on the bush for a longer period, so affording ideal conditions for rapid multiplication and spread of the disease when climatic conditions were favourable. It therefore seemed preferable to tip earlier, but not lower. Early tipping during dry periods would stimulate the production of secondaries and tertiaries, which might have time to mature and become resistant before climatic conditions again became favourable for the fungus.

Neither early tipping nor short rounds would entirely eliminate the disease from young fields as there was a good deal of infectable young growth below the plucking surface. In older fields the young growth was mainly, though not entirely, above the plucking table, so short plucking rounds would keep the amount of infectable material at a minimum. It was on record that, in India, the harvesting of the greater portion of the third leaf, together with the bud and two leaves above it, reduced the incidence of the disease and maintained

crop. Apart from the 'coarse' plucking, the method reduced the area of infectable leaf on the bush, without reducing the number of buds available for further growth. The temporary *eradication* of the disease by completely stripping every piece of young growth from every bush at intervals shorter than the incubation period of the fungus, while theoretically possible, was in practice impossible. Even were it carried out, there would still be risk of immediate reinfection in the same way as in 1946 either from abroad, from abandoned areas, or from some overlooked source.

One of the most convenient compounds for spraying on the bush to give protection to foliage was 'Perenox.' This was normally obtainable in Colombo at Rs. 1-25 per pound, but supplies recently had not kept pace with the demand. It was prepared for use by stirring the powder into water at the rate of 1 ounce to 2½ gallons of water and was thus far easier to prepare than were Bordeaux or Burgundy mixtures. The frequency of spraying depended largely upon the rate at which new infectable leaves and stems were formed. Spraying protected existing leaves from new infections, but not from those which had already occurred. As new leaves were produced further spraying should be carried out when periods of suitable weather occurred. It would not always be possible to spray effectively during the South-West Monsoon. The amount of copper reaching the soil as a result of using copper fungicides would never, under normal circumstances, be sufficient to injure the fertility of the nursery. Hexylresorcinol had not been tested against blister blight, but from the information available its high cost would rule out its general use even if it proved effective.

Spraying of young fields in Uva during the dry months was not recommended as



its efficacy would not be sufficiently great to be economic. At such a time the climate would be giving a more effective control. Collection of infected leaves should only be done at times of low incidence and be as thorough as possible. It should not be confined to infections on young tissues alone.

There was no evidence that manures made bushes either more or less susceptible to the disease. In the instances given during the discussion the interval between the application of the manure and the appearance of the disease was not sufficiently long, in Dr. Eden's opinion, for the manure to have had any effect on growth. Its effect on growth would almost certainly occur before any change of leaf structure or composition affecting susceptibility became evident. When manures had stimulated the bushes, the presence of the extra young and susceptible growth might give the impression of increased susceptibility when conditions were favourable for the fungus. Until more was known of the seasonal incidence of blister blight in Ceylon no rational adjustment of manuring programmes could be recommended. That subject would require consideration when the facts relating to it were known.

So far the disease had caused no severe general loss and that loss was of crop rather than of bushes. On the whole the damage had been less than that expected. Although the climates of Ceylon and S. India were somewhat alike the damage, according to reports from S. India, appeared to have been greater there. That might have resulted from heavier shade. A fungus however could distinguish, and would respond to, differences in climatic conditions that man would not notice, and for that reason it was unsafe from knowledge of a fungus in one country to predict its exact behaviour in another.

Mr. G. M. Oakes, invited by the Chairman to give his experience of the disease in Assam, stated that the disease was controlled there mainly by natural factors. It was usual in most districts in Assam to spray against red spider with lime sulphur solution during the cold weather, which was also the dry weather, but whether that had any effect on blister blight he could not say. Pruning was also done during the cold weather. The climate was very different from that in Ceylon. His experience in Assam was not extensive but he had never seen nor, he thought, had Tocklai ever been called upon to deal with the disease on the scale that had occurred in Ceylon.

Dr. Gadd said that there appeared to be an idea that blister blight could be eradicated. If so, it should be forgotten. Now that the disease had arrived in Ceylon it would remain there. That did not mean that the disease would necessarily always be of serious importance. By suitable control measures a major pest could be reduced to minor importance, but rarely, if ever, could it be eradicated. Instead of thinking of eradication they had to consider control by cultural or other methods, which would reduce to a minimum the damage caused by the fungus. Any scheme by which an attempt was made to collect and destroy every infected leaf would only prove futile. A minute quantity of spores somewhere would surely be overlooked. He asked them to consider how much infectious material originally entered Ceylon last year. He did not imagine that it could have been any appreciable quantity. It may have been only a few spores, microscopic in size. Yet after two or three months the fungus could be found, only too easily, in practically the whole tea area of Ceylon. That experience clearly showed how rapidly, when conditions were favourable, a small



amount of the fungus could increase and multiply and spread over a large area. It also made evident how impossible it would be to eradicate such a fungus.

The problem was one of control not eradication. Climate was undoubtedly the most important factor affecting control but it might be necessary to assist nature by cultural or other methods, even perhaps by spraying, which he hoped could be avoided, except perhaps for nurseries. He hoped that his emphasis of this point would not be misunderstood. He was not pessimistic about the disease as he believed that it would be effectively controlled though not eradicated.

Mr. Kenneth Morford said that Dr. Gadd in his opening remarks had indicated a shortage of senior staff at the Institute and the difficulty of obtaining more scientific officers. He recognised that these conditions might prevent the necessary attention being given to blister blight and any development which might arise in connection with that disease. Dr. Tubbs had fairly stated that what might happen during the South West Monsoon was unknown. He (Mr. Morford) felt certain that all were anxious and desirous of some assurance that should it be necessary for an officer to be relieved of all other duties in order to devote himself solely to the study of this pest and to travel here and there whenever necessary, an officer would be freed and given facilities to do so. His District Planters' Association had passed a resolution to the effect that steps should be taken to ensure that an officer would be free to give his whole time to blister blight. It may be necessary for someone else, not necessarily a scientist but perhaps an amateur scientist to act as 'locum' for the senior officer who had to devote himself to this menace. But whatever arrangements had to be made he asked, with the full

support of the Conference, that work on blister blight should be given priority.

Dr. Gadd assured Mr. Morford that the subject of blister blight would not be neglected. Since the outbreak of the disease, apart from the time he himself had been able to devote to the subject, Dr. Tubbs and the staff of the Mycological Division had concentrated on the study of that disease. That work would continue till the facts were known. Their job was to get the facts, though often that proved a slow process. They were not prepared to say what was going to happen during the next South West Monsoon period nor even during the next North East. They must wait to see what would happen then and to ascertain how the fungus would behave under those conditions. That could not be foretold with any certainty but that sort of information was essential for rational planning. The study of blister blight would be given priority until the most efficient control measures had been devised.

In reply to a suggestion that an officer be sent to North India to study the disease there, the Chairman (Mr. Singleton-Salmon) said that it did not seem to him quite logical to send one of their overworked officers to a place where the disease had occurred for over ninety years. He would not personally go to a doctor who had failed to cure something for ninety years. What had to be studied was the behaviour of the disease under Ceylon conditions.

In response to a question concerning what the Government proposed to do regarding blister blight, the Chairman said that he could not allow that question to pass to the scientific staff as not even the best of scientists nor any man could know what any Government would do at any time.

Mr. R. F. Greer said that the Government obtained a large part of its revenue from the Tea Industry and consequently any severe damage by blister blight would cause loss to Government. It seemed to him that the occurrence of this disease in Ceylon and the work on controlling it was a matter for Government assistance. He understood that Government made no direct financial contribution towards the research work of the Institute, and it seemed right and proper that Government should give financial help in the form of a subsidy to aid the Institute and the Industry in controlling this disease.

The Chairman said he would take up the question with the Board of the Institute.

Mr. R. Brodie, speaking for those living in the south of the Island, said that they often would like an officer from the T.R.I. to come and advise them on the spot. He knew of the shortage of staff but wished to suggest that more use should be made of

the Small Holdings Officers. These officers were resident in different districts and he thought that their services should be made available not only to small holders, but to estates as well. He suggested that they be given a more thorough training at St. Coombs and made competent to give advice on estates as well as small holdings.

Dr. Gadd said that he would be very pleased for planters to make use of the services of the Small Holdings Officers in connection with this disease and he felt sure that the officers themselves would be very willing to assist in every way possible. The Small Holdings Officers' work entailed a good deal of travelling and their trouble still was the smallness of their petrol ration which to a large extent limited their activities. He assured Mr. Brodie of his co-operation in making the services of the Small Holdings Officers available should estates require them.

[The further proceedings of the Conference will be printed in the next number of the *Tea Quarterly*.]

## THE COLLECTION OF BLISTERED LEAVES

C. H. GADD

The Blister Blight disease of tea gets its name from the presence of white blisters, which resemble circular pieces of dough adhering to the under-surface of affected leaves. The white tissue is the fungus *Exobasidium vexans* which causes the disease. Spores are produced on its surface in large numbers. They are microscopic, and when ripe, are carried large distances by air currents. It is possible that the disease arrived in Ceylon as spores carried through the air from South India, though no proof of it can be offered, but it is undoubted that the disease was rapidly

distributed through the tea areas of Ceylon, even to Uva, by air currents.

Where the spores will fall is entirely a matter of chance. Only those which find lodgment on the under surface of young tea leaves or on very young stems have any chance of survival, and then only if climatic conditions are favourable for their growth. It will be realised that only a small fraction of the spores produced can possibly survive, yet sufficient do survive to cause a very large number of infections in the tea fields. When the leaf surface is



wet with dew or rain, spores adhering to it begin to grow. A small tube or thread (hypha) grows out from the spore and enters the leaf through one of the pores (stomata) on its under-surface. There are very few (if any) stomata on the upper-surface of the tea leaf and, consequently, spores on the upper-surface rarely cause infection. Once the hypha has entered the leaf the fungus is safe and well protected from adverse climatic conditions, such as dryness; it continues to grow and branch, but entirely within the leaf. The area invaded by a germinated spore is limited to the circle which later becomes the blister. For some days there is no visible evidence that a leaf has been invaded, and usually, about three weeks elapse before a white blister is fully formed. The period of three weeks is of course only approximate; it may be shorter or longer depending on external conditions; humidity and temperature being of greatest importance. For the greater part of the period, however, there is no very obvious sign that the leaf has been infected.

Now let us assume that the first blister has been observed in a tea nursery today and we decide to spray in order to protect the young plants. Before starting operations let us consider what the occurrence of that one blister means. First, it is certain that spores were passing through the nursery about 3 weeks ago, and probably others have passed into it daily ever since. How many of those spores have lodged on the leaves and how many have germinated and caused infection we do not know, but we shall certainly learn during the coming three weeks. If during the previous three weeks climatic conditions have been favourable for the germination of the spores a large number of plants are already infected.

At this stage we can spray the plants, coating them carefully and thor-

oughly with a fungicide, realising perhaps that the work might have been more beneficial had it been done three weeks earlier. What benefit is likely to be derived from the spraying? Surely we have protected the existing tissues against further infections. Newly arriving spores will be killed by the poison before or after germination, and before the hyphae can gain entrance into the leaves. Although the plants have been protected for a time against future infections, the spray can do nothing about the earlier ones. Sprays are not curative. Those leaves which were infected during the three weeks the first blister took to develop will ultimately all carry blisters just as though they had not been sprayed. If instead of spraying the whole nursery we spray only one half of it, we ought not to be surprised if during the next three weeks as many blisters occur in the sprayed area as in the unsprayed area of the nursery. Whether the spray has given beneficial effects or not must be decided from the blisters developing in the sprayed area about 3 weeks after spraying. During the three weeks after spraying the plants will have grown, *i.e.*, they will form new susceptible tissue, and perhaps the fungicide will have been washed off by rain, and so the plants will then no longer be protected completely. Spraying has, therefore, to be repeated at intervals to give complete protection.

Now let us suppose that instead of spraying the plants we decided to pluck and destroy the blistered leaves as they became evident. There will be the satisfaction that at least some of the fungus will be destroyed, and that the blisters we collect today will produce no more spores. During the next three weeks, however, blisters will occur in exactly the same numbers as if the plants had been sprayed. But in addition new infections will occur because the young leaves are not protected,

and, so, in consequence, more blisters will develop later. We are therefore justified in asking whether the collection of blisters can do any real good? To that question it is impossible to give a straight and exact answer. If no other blisters existed elsewhere outside the nursery, then collection would obviously be beneficial, but blistered leaves are far more numerous outside the nursery than within it, and the destruction of blistered leaves within the nursery can do nothing to stop spores coming in from outside. The collection of blistered leaves, however, is a matter to be considered in connection with tea in full plucking rather than with young plants in a nursery, so we may leave the nursery at this point with this conclusion: Blistered leaves should not be plucked in nurseries; spraying should be resorted to.

Turning now to infected tea in full plucking. The experience not only in Ceylon but everywhere the collection of blistered leaves has been attempted, is that whenever the disease takes epidemic form the collection of blistered leaves cannot keep pace with the production of blisters. That clearly indicates that under adverse conditions collection is useless. It may be worse than useless, as collection can do more damage than the disease itself.

Let us assume that a leaf carries one or more blisters which cover one-fifth of its area. Obviously, 20 per cent of the leaf is dead or dying *i.e.*, where the blisters are, but the remaining 80 per cent is green and carrying out its normal functions. It will be evident that by plucking that leaf one can do four times as much harm to the bush as the fungus has done via that leaf. As an extreme case, suppose every leaf on a bush is infected, the collection of all blistered leaves will mean the removal of every leaf except the few youngest in which the disease has not developed sufficiently

far to be evident as blister. That stripping will certainly do more damage to that bush than the disease itself would do. By stripping, a certain amount of the fungus is destroyed which perhaps is a small advantage, but can that benefit outweigh the destruction of a large amount of healthy tissue? Surely the answer must be 'No.'

The collection of blistered leaves is somewhat similar to what was done in Ceylon some years ago, the collection of leaves carrying Tortrix egg masses. There is one big difference however. The white blister is more analogous to the female moth after she has started to lay eggs. The blister produces infinitely more spores than the Tortrix moth does eggs, and they are smaller, invisible to the naked eye and are dispersed through the air. After egg masses had been collected from a field few would be absolutely confident that none had been overlooked. After blister collection, one can be certain that a very large number of spores have not been collected. Mention has already been made of the fact that at times blisters are produced faster than the labour force can collect them. That was never the experience with Tortrix egg mass collection. This brief comparison serves to show that blister collection must be far less efficient as a method of control than the collection of Tortrix egg masses was.

We have seen that the tissues most susceptible to attack are the young leaves and stems, but evidence of their infection is not visible for sometime later till blisters are formed and spores are being produced. If the development of new blisters is to be prevented, it will be obvious that the best way to do it is by the removal of all young growth. That young growth is commonly known as 'flush' and is what is collected as harvest. By short plucking rounds and hard plucking, *i.e.*, plucking to the fish leaf,



it may be possible to prevent the full development of new blisters and so prevent production of spores. The life of a fully developed blister depends upon weather conditions; it is shortest during hot dry weather. If the development of new blisters could be entirely inhibited, the death of all old blisters would result in the eradication of the disease. That would be perfection and is not likely to be achieved. But it will be evident that the removal of young leaf as rapidly as possible must very materially reduce the number of new blisters that can develop.

If we now compare the values of plucking and of collecting blisters there can be no doubt whatever that plucking is the more effective method of control. It is a waste of labour to collect blistered leaf when it can be more usefully employed plucking for harvest.

Hard plucking and short rounds do not result in immediate loss of crop. That fact has been proved conclusively by experiment.

No doubt there are many disadvantages attached to such treatment if persisted with, but hard plucking is here recommended as a means of controlling blister blight, and not as a general practice. Normal plucking can be resumed during periods unfavourable for the dissemination of the disease.

When blister blight first appeared in Ceylon the Institute advised the collection of blisters in the hope that its rate of spread might be retarded. It soon became evident that collection could not keep pace with the formation of new blisters and the recommendation was withdrawn. If collection is of value at any time, it is when blisters are few and weather conditions are unfavourable for the fungus, but there must be some doubt even about that. Whatever one's opinion may be concerning the collection of blisters as the main method of direct attack on the fungus, there can be no doubt that where the bushes are in plucking, short rounds coupled with hard plucking are by far the best measure of control.

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## RECORDING THE INCIDENCE OF BLISTER BLIGHT\*

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Experience has shown that the severity of Blister Blight varies not only in different fields but also in different parts of the same field. That variation is due partly to the age of the bushes from pruning and partly to elevation, aspect, shade, contour and other factors. The incidence of the disease will also depend on the weather, and so will vary with the months. It will be least in the dry months, but we do not know that it will necessarily be worst in the wettest months. Possibly there will be fewer bad months in the low-country than at

higher elevations, and the worst months may not be the same for all districts. Accurate information will be necessary before rational control measures can be devised, and the collection of that data is of importance.

Damage is greatest in recently pruned fields' as the whole of the new growth may be destroyed, and least in fields in full plucking. It will be evident, therefore, if blister blight becomes a permanent menace, that the time of pruning may have to be adjusted

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\*A circular issued by the Tea Research Institute to estates through the Ceylon Estates Proprietary Association in April, 1947.

so that bushes are in their most susceptible stage at the time when the incidence of the fungus is likely to be least. The period in which pruning may safely be done may be very limited in some districts, and some fields may have to be pruned at times which give increased risks. If risks have to be taken, they will be smallest if taken with fields known to be least susceptible to the disease.

It seems advisable therefore that every estate should record observations of the relative susceptibility of the different fields in the different months of the year. The following suggestions are offered with the object of helping to devise a simple form of recording.

#### *Severity.*

It is inadvisable to classify severity under more than 5 headings, each of which can be indicated by a numeral.

- 0 Disease absent or difficult to find
- 1 Disease apparent as white blisters on leaves. Blisters per bush not very numerous; some bushes unaffected.
2. White blisters numerous, but stems unaffected.
3. Many young stems somewhat damaged but not killed throughout their length.
- 4 Young stems severely damaged, many completely destroyed.

It will be evident that in the above classification categories 3 and 4 will refer mainly to young fields. Very rarely would a whole field in plucking have to be classed in a category higher than 2 unless left un-

plucked or unless the rounds are not short enough. This classification readily divides into two, viz. 0, 1 and 2 for plucking fields and 0, 3 and 4 for pruned fields. There can be no doubt however that the greatest damage is done when bushes are classified as 4.

In the above only white blisters are referred to. If the blisters are black and dried out, they should be regarded as non-existent. A change of classification from 2 or 1 to 0 can only mean that the blisters have dried out or have been collected.

#### *How many records per month?*

Normally two should be sufficient, the first about the middle of the month and the second at the end. More frequent records may be considered necessary in young fields and four might be advisable in some months.

#### *Should a field be recorded as a whole?*

That depends largely upon its size and natural features which may affect susceptibility, such as shaded hollows, aspect and elevation. Where a field is divided into areas these should be defined as simply as possible, *e.g.*, "Eastern and Western aspects," "Above and below cart road," etc. It is desirable that the pruning dates for each area should be recorded separately and no area should be larger than can be pruned in a fortnight.

#### *Notes.*

Space will be required for notes. These should be as brief and clear as possible, and give only such information as cannot be derived from the records. There is no point in noting that the disease started or became much worse in a certain month as that will be obvious from the numerical record. The notes will most probably refer to type of pruning and lopping of shade. As regards pruning, it is essential that this should be



as light as possible. Hard pruning must be abandoned if for nothing else than to get the bushes through the most susceptible stage as soon as possible. If light pruning is adhered to, no mention of it need be made except when the bushes for some reason or other are pruned more heavily, when the

of the stems are killed the dash (—) should be used after the record 4 to indicate no living leaves or stems. When new ones develop and they remain healthy, the fact is recorded as 0.; if attacked immediately, the entry 1 or 3 would indicate that fact and the severity.

FIELD No. 4						YEAR 1947						
AREA 14 acres						LAST PRUNED Dec. 7th-15th, 1945						
	Jan.	Feb	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A	2,2	2,1	1,1									
B	1,1	0,0	0,0									

NOTES: Area A. Lower, near stream. Pruned Dec. 7th-11th, 1945  
 „ B. Upper area. Pruned Dec. 12th-15th, 1945

fact should be noted. The date of lopping of shade should be recorded.

#### *Record Sheet.*

Having decided what information is required a record sheet may then be designed. The layout might be as shown but it is offered merely as a suggestion.

#### *How to record.*

First determine the average severity of attack and then enter the numeral representing that degree in the column for the month. For instance a young field is free from disease (0) at the beginning of October, in the second week blisters on a few leaves (1) are seen and at the end of the month the disease is on the stems (3). The figures 0113 would be entered under October, or if only two records per month are thought necessary, they would be 1, 3.

If a field is clean pruned, 0 should not be used until buds break and young stems and leaves are formed. The absence of these can be indicated by —. Similarly if a field is so badly damaged (4) that the majority

Where fields are rim-lung pruned, it may be advisable to pluck the lungs normally to avoid development of blisters on the young leaves. Recorded observations would then refer to the pruned branches.

#### *Method of filing.*

The loose leaf system is the best as it allows all records relating to one field over a number of years to be brought together. If the record sheet is sufficiently large, the records for successive years may be entered on it. It is advisable not to have records relating to different fields on one sheet.

#### *Use of records.*

The purpose of the records is to provide accurate data upon which estates may each base its own pruning programme. That information is essential if the best programme is to be planned, and it is of more use on paper than stored in the memory; it can at least be handed on whenever there is a change of management.

## BLISTER BLIGHT\*

F. R. TUBBS

A general survey of the possible methods of controlling blister blight was given at the Tea Conference in February. The short experience of the disease then available precluded detailed treatment of the subject. But the experience obtained during the last ten weeks justifies further consideration of the measures to be adopted pending the evolution of a settled policy based upon prolonged experience of the disease.

Damage is greatest in fields recovering from pruning, where the death of buds and young shoots may delay normal production for several months. This delay is greatest when infection of the young shoots occurs soon after bud-break, and least when infection only takes place after most of the growth below the tipping level is old enough to have acquired immunity. Even at this stage, however, loss of crop will result if the multiplication of secondary shoots to form the new plucking table is interfered with. The severity of the disease has everywhere been found to be closely associated with the climatic conditions preceding the outbreak, being greatest so far after wet or misty weather.

The risk of damage from blister blight during recovery from pruning may be met in three ways: firstly, by adjusting the pruning programme so that bud-break occurs at the beginning of the dry period, secondly, by lighter pruning to avoid jeopardy to the frame and to the spread of the bush, and also to increase the rate of recovery; and thirdly, by variations in tipping procedure.

The season at which the bulk of the pruning programme should, if possible, be carried out will depend upon the district. In those districts receiving the North-East Monsoon only, the advantage of recovery during dry weather, when the disease is at a minimum, will be obtained if bud-break occurs in June or soon after. With normal pruning, this will result if the programme is commenced in May. It is desirable to prune as large an area as possible in May and June so as to allow a long dry period in which to reform the plucking table to as large an acreage as possible. Allowance should be made in the programme for variations in the period elapsing between pruning and bud-break. Since bud-break occurs more quickly on young branches than on old, the order of pruning of the various fields should be so arranged as to allow of progressively lighter pruning being carried out the nearer the end of the dry weather. "Lighter" should here be understood to refer to the proportion of new wood and the closeness of the "points" left upon the pruned frame rather than to height of pruning. Conversely, in those cases where a heavy cut-down is considered unavoidable, the work should be carried out in, say, April rather than May, depending upon the anticipated delay in bud-break.

The extent to which such a programme can be adopted is dependent on factors other than a desire to avoid damage from blister blight. Considerations of labour, or other reasons, may dictate that only a proportion of the pruning programme can be fitted into the desired months. But it will not escape

\* Lecture delivered before the Nuwara Eliya P. A. on Thursday, May 15, 1947.



notice that longer cycles, where justifiable in the new circumstances connected with blister blight, will reduce this difficulty by decreasing the acreage to be pruned annually. To achieve this advantage by heavier pruning will be, however, merely to introduce a further risk from blister blight.

Two considerations should be borne in mind when choosing those fields that must unavoidably be pruned into wet weather. Firstly, those upper fields, where mist lies heavily during the monsoon, those on steep western slopes, and others where the disease has already proved to be abnormally prevalent, should be avoided. Secondly, no fields that cannot be lightly pruned should be included. It may be possible, on those estates covering a considerable range in elevation, to arrange for the wet weather programme to be confined to the lower elevations where recovery is more rapid, provided experience has indicated that the disease is less prevalent than at the higher elevations.

The application of such a policy to estates in those districts which receive both the South West and the North East Monsoons meets with difficulties arising from the short and variable length of the dry period. The possibility that late March, April and May, might have proved very favourable to the disease precluded any early decision, and rendered the revision of pruning programmes a matter of guesswork. But during the last three months the periods of dry weather have proved sufficient to check the increase in blister blight that has followed some three weeks after every showery spell. As a result, it can be said that, *in general*, conditions from mid-January to mid-May have proved unfavourable to the disease. Bearing in mind that January 1947 was wetter and mistier than

usual, and that next year the disease may be checked slightly earlier, the advantages of dry weather recovery will be obtained in those fields pruned from about the first of December onwards. Until we know more of the severity of the disease during the conditions of the South West Monsoon, pruning between the 1st of December and the end of February offers as great protection as possible against the loss of crop that follows upon delayed recovery. The selection of fields for this programme should be governed by the same considerations in the South West districts as in the North East.

Experience may prove that in some localities spraying during the period of bud-break and tipping may sometimes be desirable. Such a programme should not be lightly entered upon, since the spray is protective and not curative. The consequence of this is that repeated sprayings at short intervals would be necessary to obtain adequate protection of the new tissues as they form. Some ten sprayings, each involving the application of about 150 gallons of fluid per acre, might be required to give protection over the whole recovery period. It is obvious that in certain circumstances prevention might prove more expensive than the disease. The efficacy of the far cheaper process of dusting with fungicidal powders, compared with spraying, can only be determined as and when such powders become available in Ceylon. Sulphur has so far proved of little or no value.

The subject of tipping procedure may now be considered. The problem is basically the same as that just considered, *i.e.*, how best to ensure the safe development of the buds or the tipping shoots into secondaries filling up the plucking table. If all the secondaries are forced into growth together, they all become susceptible together. The

risk arising from this may be avoided if shoots are tipped as they come up to the chosen tipping level. Such treatment avoids the loss of crop involved by late tipping and so may compensate to some degree for loss from blister blight. However, when the dry weather is due, as in Uva now, some delay in tipping will of course confer greater safety. It is stressed that the early tipping proposed does not involve low or hard tipping. Such treatment is definitely harmful.

The treatment of pruned tea having been dealt with, it is necessary to consider the plucking fields. The possibility of serious damage here is very much smaller but is nevertheless sufficient to warrant our serious consideration. There are shoots in every stage of development on bushes in plucking. Those that become infected in the early bud stage die right back and are lost. In severe cases the effect of this is to produce the appearance of the bushes having been lightly skiffed. Fortunately, attacks of such severity are not usually uniform over large areas, nor of long duration. In some cases they may be partly compensated for by a heavy secondary flush. There is no treatment that can be applied, at an economic cost, to protect *arumbu* from such attacks, but flush which has reached a later stage of development when infection occurs can be saved by short rounds combined with close plucking, for a round of two only, after each attack becomes apparent. There are many opponents of close plucking, but it cannot be gainsaid that it is preferable, during the period of severe attack, to the alternative policy of leaving young flush and the third leaf on the bush to develop a mass of blisters later. There is no point in long continued close plucking — the aim is to harvest those young shoots that are infected at the time, before blisters can

develop. It may be pointed out in this connection that, during wet weather, leaf infections may be so general as to be of relatively small importance. It is the occurrence of bud and stem infections that we have to watch for, and to study primarily.

Should the expectation be justified that estates in Uva will be relatively free of the disease during the coming dry weather, policy can now be planned on the basis of what amounts, in practice, to a full year's experience of the disease. Estates exposed to the South West Monsoon will not be so fortunately placed for another six months or so. Nevertheless, as I have pointed out, both areas now have sufficient experience of the disease to allow of the adjustment of the pruning programme to make full use of the most potent factor in the control of the disease, that is, the season of pruning.

To alter programmes carefully developed during long years of freedom from the disease must involve some difficulty, and perhaps loss. Each estate must now balance, in the case of every field still due for pruning this year, the loss and inconvenience of change against the possible loss from blister blight. The decision must be come to in the light of local experience, bearing two facts in mind. Firstly, experience of the disease so far has justified the "cautious optimism" beloved of statesman, rather than the alarm of the pessimist. Secondly, the risk of some loss, if fields are made to recover from pruning during weather favourable to the disease, is so great as to amount to a certainty. What we do not know is whether the South West Monsoon will prove favourable to the disease, nor, if so, how serious the loss will prove to be. But risk undoubtedly exists. It is essential that our uncertainty should not



lead us to drift through the experience of the next six months. We should either accept a calculated risk, or arrange cover against it, by the appropriate adjustment of the pruning programme, however drastic this may seem. The policy adopted must be regarded as an interim one, to be brought up for revision as experience of the disease in the South West Monsoon and early North East accumulates.

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## MINUTES OF A MEETING OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON HELD 13-12-46

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Minutes of a Meeting of the Board of the Tea Research Institute of Ceylon held at the Rooms of the Ceylon Tea Propaganda Board, Colombo, on Friday, December 13th 1946, at 2-30 p.m.

*Present.*—The Chairman, Planters' Association of Ceylon (Mr. R. Singleton-Salmon), Acting Chairman; Mr. H. E. Peries, C.C.S. (representing the Financial-Secretary); the Chairman, Ceylon Estates Proprietary Association (Mr. C. A. Meakin); Messrs. S. Vytilingam, M.S.C., J. C. Kelly, H. de T. Wilkinson Kay, E. G. Groves, W. H. Attfield, F. A. Bond and Dr. C. H. Gadd (Acting Director and Secretary), Mr. F. C. Daniel (Superintendent, St. Coombs) attended by invitation.

Apologies for absence were received from the Director of Agriculture (Mr. L. J. de S. Seneviratne, C.C.S.) and Mr. H. S. Hurst.

1. The Notice convening the Meeting was read.

2. *Obituary.*—The Chairman said: "It is with very deep and sincere regret that we record the death, on October 14th, of Mr. R. C. Kannangara, M.S.C., a Member of this Board. Although we did not always

see eye to eye on all matters, no one could doubt his sincerity and the gallant fight he always put up for any principle he considered right. This Board, and in particular the Small-Holders whom he represented, have suffered a great loss at his passing."

A vote of condolence was passed, members standing.

3. The Minutes of the Meeting held on September 18th, 1946, were confirmed.

### 4. MEMBERSHIP OF THE BOARD AND COMMITTEES

(a) *Board.*—The Chairman reported that:—

(i) Mr. C. A. Meakin, on taking over the Chairmanship of the Ceylon Estates Proprietary Association had become *ex-officio* Member of the Board, *vice* Mr. E. E. Spencer (vacated) September 16th, 1946.

(ii) His Excellency the Officer Administering the Government had been pleased to nominate Mr. S. Vytilingam, M.S.C., to serve as Representative of the Small-Holders on this Board in place of the late Mr. R. C. Kannangara for a period of three years with effect from 15th October, 1946

(iii) Mr. J. C. Kelly had been re-nominated by the Ceylon Estates Proprietary Association to serve for a further period of 3 years as its Representative with effect from December 4th, 1946.

The Chairman welcomed Messrs. Vytlingam and Meakin and expressed pleasure that the Board would continue to have the benefit of Mr. Kelly's assistance and long experience of the Board's work.

(b) *Estate and Experimental Sub-Committee.*

(1) Mr. P. D. Cruickshank had consented to serve on the Committee in place of Mr. W. J. Craig (resigned).

(ii) Mr. F. A. Bond had consented to act for Mr. D. T. Richards while on leave.

## 5. JOINT RESEARCH ON THE CHEMISTRY OF TEA

Reported that the following details concerning the cost of these investigations in London had been received from the Secretary of the Ceylon Association in London

Dr. Bradfield's salary is at present £1,050 per annum rising by £50 per annum to £1,250, and the Committee hopes to get an Assistant whose salary would not be less than £350 per annum. Allowing £100 for apparatus, etc. the present minimum cost will be £1,500 rising to £1,750 per annum.

As the Netherlands East Indies have intimated their inability to contribute towards this research until conditions become normal in that territory, Ceylon's contribution would become 25/63 instead of 25/80 of the cost. Ceylon's share would thus become Rs. 8,000 rising to Rs. 9,250 per annum (approximately).

The Board decided unanimously to continue to subscribe towards this research at the enhanced rate.

The Chairman also reported that the Secretary of the Ceylon Association in London in his letter of 23rd October, 1946, wrote :—

"As it appears that this investigation is virtually under the sole control of that Association (the I.T.A.) our President considers that it would be a more equitable arrangement if its administration could be transferred to the International Tea Committee."

The Acting Director was instructed to reply that although the Board was well satisfied with the manner in which the I.T.A. had exercised its control, it would raise no objection to the transference of control to the International Tea Committee should the Ceylon Association in London so desire.

## 6. MINUTES OF THE ESTATE AND EXPERIMENTAL SUB-COMMITTEE OF

4-11-46

### (i) *Supplementary Estimates.*

The following additions to the 1946 estimates, recommended by the Estate and Experimental Sub-Committee, were sanctioned.

*Lines* (Vote 12) Rs. 375.

*Food Production* (Vote 14).—Cess on 159.92 acres Rs. 2,398.80 being due for half 1944 and the whole of 1945.

*Bunding of Ravines and Leader Drains.* (Soil Erosion Vote 29) — Rs. 175.

*Boundaries and Ravines* (Vote 31).—Rs. 200.

*Illuk and Cooch* (Vote 33).—Rs. 250.  
*Contingencies* (Vote 7).—Rs. 500.



## 7. FINANCE

(a) Accounts to 31st October, 1946 were approved.

### (b) *General Finances.*

The Chairman reported that the Finance Sub-Committee had discussed the question of the Institute's Finance as indicated in the Acting Director's Memorandum issued to all members. As a result of that discussion it was evident that the Board was faced by two alternatives (1) to proceed with the approved programme or (2) to reduce expenditure until such time that increased revenue becomes available.

In the discussion that followed the urgent need of an increased revenue was recognised generally and Mr. Peries undertook to consult the Financial Secretary on the question.

Mr. Kelly expressed the view that the Institute should go ahead with its plans even though it might entail a severe depletion of reserves. In the meantime steps should be taken to get the cess raised.

After further discussion this line of action was agreed.

### (c) *Buildings.*

The Chairman reported that the Buildings Committee had considered estimates for 3 junior staff bungalows.

On the proposal of Mr. Meakin seconded by Mr. Bond, the Buildings Committee was authorised to proceed with the erection of the three bungalows.

### (d) *Conference.*

The Board approved the recommendation that a Conference be held at an early date. A Sub-Committee consisting of the Chairman, Mr. H. S. Hurst, and the Acting Director was appointed for the purpose.

The Research and Estate estimates as amended by the Finance Sub-Committee were approved unanimously.

## 8. SENIOR STAFF

### (a) *Appointment of Superintendent.*

The Chairman reported that the Selection Committee, after a careful study of all the applications, was of the opinion that none was sufficiently outstanding to warrant a further change and that the Acting Superintendent (Mr. F. C. Daniel) should be offered the post. The Committee also recommended that he be appointed at a salary of Rs. 1,100 per mensem, to date from November 27th, 1946, but that his service for leave should count from May 27, 1946, the date of his taking up the acting appointment.

As his new duties would include the care and maintenance of all buildings, water supply and electric power, the Acting Director was of the opinion that the estate should carry 70 per cent of his salary, etc. the balance being accounted for in the research estimates.

The Board unanimously approved the appointment of Mr. F. C. Daniel as Superintendent of St. Coombs Estate on the above terms as recommended by the Selection Committee.

### (b) *Dr. F. R. Tubbs.*

The Chairman reported that Dr. Tubbs had recently received the following honours for services with the military forces.

Knight Officer of the Order of Orange Nassau (Netherlands).

Croix de guerre 1940 avec Palme (Belgium).

Chevalier de l'ordre de Leopold II avec Palme (Belgium).

The Board requested the Chairman to convey to Dr. Tubbs their congratulations.

(c) *Mr. J. Lamb.*

An increment of Rs. 50 per mensem to his salary was sanctioned as from February 12th next.

The Chairman reported that Mr. Lamb's return from leave was delayed owing to the difficulty of obtaining a passage.

(d) *New Officers.*

Reported that news had been received from the Secretary of the Ceylon Association in London that no applications had been received for the posts of Mycologist and Agricultural Officer. In view of the earlier decision, provision for these officers had been left in the 1947 estimates and the posts will be filled as opportunity occurs.

## 9. JUNIOR STAFF

(a) *Mr. H. B. Sreerangachar.*

The Chairman reported that Mr. H. B. Sreerangachar had been awarded the degree of Doctor of Science at the Bombay University for researches in the Biochemistry of Tea.

The Board directed that their congratulations be conveyed to Mr. Sreerangachar.

(b) *Mr. F. D. Tillekeratne.*(c) *Junior Staff Association.*

Reported that a request had been received from Mr. Tillekeratne for a revision of his and other small-holdings officers' salaries.

Since then, a case had been presented by the Junior Staff Association pressing for a revision of all Junior Staff salaries, and a copy of their letter (Memo. 2 of 1946) had been issued to all members.

The Chairman said that the two cases might be considered together. Salary scales had last been revised in 1945, but he realised, as the Staff had emphasised, the cost of education of children fell heavily on residents of St. Coombs.

Mr. Bond proposed and Mr. Wilkinson Kay seconded that the matter should be deferred till the return of the Director and Chairman to the Island when a Sub-Committee should be appointed to consider the question.

The motion was passed unanimously.

## 10. BLISTER BLIGHT

The Acting Director said that the Government of Ceylon had for many years taken every precaution, including the prohibition of import of tea seeds, to prevent the entry into Ceylon of a disease known as Blister Blight which was caused by the fungus *Exobasidium vexans*. In October this year the disease mysteriously arrived and was reported from Dolosbage. Within a month it was also reported from Pussellawa, Matale, Madulkelle, Ramboda, Dimbula, Dickoya, Kotmale, Ginigathena and Maskeliya. More estates were reporting its presence daily. So far it had done no very serious damage. It was a disease which depended upon the weather and for that reason, given a dry sunny period, it may disappear as readily as it came, but there would always be a liability of its occurrence.

## 11. ANY OTHER BUSINESS

(a) *Loan to Small-Holdings Officers for News Cars.*

Reported that Mr. Illankoon had applied for a loan of Rs. 4,000 for a new car to be repaid in instalments of Rs. 150 per mensem.

The loan was sanctioned subject to the rules governing such loans.

(b) *Dates of Board Meetings.*

Reported that the Director of Agriculture had called attention to the difficulty of arranging dates of Board Meetings convenient for all members and suggested that some better arrangement than the present one could be arrived at.



After a short discussion it was ascertained that Monday was the most convenient day, and it was decided to fix the dates of Meetings for 1947 as February 17th, May 19th, August 18th and December 8th.

The Meeting terminated with a vote of thanks to the Chair.

C. H. GADD  
Acting Secretary

## MINUTES OF A MEETING OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON HELD 17-2-47

Minutes of a Meeting of the Board of the Tea Research Institute of Ceylon held at the Rooms of the Ceylon Tea Propaganda Board, Prince Street, Colombo, on Monday, 17th February, 1947, at 2-30 p.m.

*Present.*—The Chairman, Planters' Association of Ceylon (Mr. R. Singleton-Salmon), Acting Chairman; Mr. H. E. Peries, C.C.S. (representing the Financial Secretary); the Director of Agriculture (Mr. L. J. de S. Seneviratne, C.C.S.); the Chairman, Ceylon Estates Proprietary Association (Mr. C. A. Meakin); Messrs. W. H. Attfield, S. Vytilingam, M.S.C., F. Amarasuriya, H. de T. Wilkinson Kay, E. G. Groves, F. A. Bond, H. S. Hurst and Dr. C. H. Gadd (Acting Director and Secretary).

(1) The Notice convening the Meeting was read.

(2) The Minutes of the Meeting held on December 13th, 1946, were confirmed.

After a short discussion of a suggestion by Mr. Wilkinson Kay that the Minutes should contain fuller reports of discussions, it was decided that no alteration be made at present, and that the subject be reconsidered after the Planters' Association Headquarters have moved to Colombo when arrangements might possibly be made for a stenographer to attend the Meetings.

### 3. MEMBERSHIP OF THE BOARD AND COMMITTEES

Reported that Mr. W. H. Gourlay had been appointed by the Ceylon Estates Proprietary Association to act for their representative Mr. J. C. Kelly during his absence on leave.

### 4. FINANCE

*General Finances.*—Reported that the Acting Director had prepared a report on the financial position showing the need for an increase in the tea cess, and had forwarded it to the Minister for Agriculture and Lands in response to his request of January 13th. In that report the need for a 50 per cent increase in the cess was shown *i.e.*, an increase of 7 cents, raising it from 14 to 21 cents per 100 lb. tea exported.

The Acting Director was instructed to send a copy of the report to the Director of Agriculture.

*Audit Fees.*—Reported that in a letter dated January 5th Messrs. Ford, Rhodes, Thornton & Co. had asked for increased audit fees for 1946 and future audits. The Chairman stated that the fees had remained unchanged for many years although salaries had increased to more than double pre-war rates.

After some discussion Mr. Hurst proposed and Mr. Bond seconded that the new rates be approved. The motion was carried *nem. con.*

*Insurance.*—The Board approved the recommendation of the Estate and Experimental Sub-Committee to make the following alterations to the insured values in the Estate Policy.

(1) *Tea Stocks.*—Increase from Rs. 20,000 to Rs. 26,000. Extra cover to be obtained should stocks or tea values increase.

(2) *Factory Building.*—The cost of the Sprinkler system less outside works to be added to the present value.

(3) *Packing Materials.*—Reduce from Rs. 20,000 to Rs. 10,000.

(4) *Firewood.*—Reduce from Rs. 2,000 to Rs. 750.

(5) *Rice and Food Stocks.*—Reduce from Rs. 12,000 to Rs. 8,000.

(6) *Dispensary Stocks.*—Eliminate as the stocks are no longer held in the factory building.

*Supplementary Estimates.*

(i) *Research Capital — Water Scheme.* The Chairman stated that in order to provide a satisfactory water service to the site of the 3 bungalows approved at the last Meeting, an alteration to the existing scheme and the provision of about 4,500 feet of 2 inch piping would be necessary.

A vote of Rs. 12,000 was sanctioned for the work.

(ii) *Research Revenue—Replacements in Senior Staff Bungalows.*—A vote of Rs. 3,000 was sanctioned for necessary replacements and repairs of floor covers and furniture, as approved at the last Meeting.

## 5. SENIOR STAFF

*Biochemist.*—Reported that Mr. J. Lamb returned to duty in Ceylon on January 13th, 1947. While on leave Mr. Lamb had spent

considerable time with blenders, other trade interests and engineering firms discussing matters in connection with his work on tea manufacture.

The Board wished to place on record their appreciation of Mr. Lamb's work while on leave.

*Acting Director.*—The Board sanctioned the application by the Acting Director (Dr. Gadd) for 8 months' leave out of Ceylon, to count from his sailing, probably in May.

The Board appointed Dr. T. Eden to act as Director during any interval that may occur between Dr. Gadd's departure and the Director's (Dr. Norris) return from leave.

Reported that Dr. F. R. Tubbs would take charge of the Entomological Division during Dr. Gadd's absence on leave.

## 6. JUNIOR STAFF

*Dr. H. B. Sreerangachar.*—Reported that Dr. Sreerangachar, Research Assistant to the Biochemist, had resigned to take up an appointment with Sarabai Chemicals Ltd., India, and that his services would terminate on March 5th.

*Mr. M. H. E. Koch.*—Reported that Mr. Koch's services as Technical Assistant to the Physiologist terminated on February 7th.

## 7. BOARD MEETING

The date of the August Meeting was altered from the 18th to the 19th. It was also decided to hold the Meeting of December 8th at St. Coombs. The Meetings of May 19th and August 19th would be held in Colombo.

## 8. MINUTES OF THE ESTATE AND EXPERIMENTAL SUB-COMMITTEE OF 18-2-47

*Visiting Agent's Reports.*—The Board accepted the Committee's recommendation



that no change should be made in the form of the Visiting Agent's Reports. The work of the Committee was appreciated.

*Agricultural Policy.*—The Director of Agriculture said that he was very interested in the remarks under Agricultural Policy and wished to know whether the measures represented practices prevalent in plantations in the area or were adopted after due experimentation. He also said that it would be very useful for new members if a summary were prepared showing a classification on the above lines.

In the case of item (f) Soil Erosion, he will be glad to be informed to what extent the measures are successful in preventing soil erosion and in maintaining soil fertility; and whether, at least, accurate observations had been kept in order to give an authoritative answer on these points.

*Manufacture.*—The Board approved the recommendations concerning experiments to determine whether a rubber roller can be adopted for use in tea manufacture and

approved the purchase of a suitable roller should the results of the experiments warrant it. The purchase of a small hand-machine for the manufacture of small quantities of clonal leaf for testing was sanctioned.

*Freezing Process.*—The Board agreed that investigation work on this process should cease and that Messrs. Lyons be approached regarding exchange of research information.

*Legge Process.*—Approval was given for the study of this process to be included in the research programme at St. Coombs.

### CONFERENCE

In reply to Mr. Vytilingam, the Acting Director stated that judging from the acceptances already received a large attendance was assured.

The Meeting then concluded with a vote of thanks to the Chair.

C. H. GADD,  
*Acting Secretary.*

## NOTICES

### VISITORS' DAYS

The second and last Wednesdays in each month are Visitors' Days at the Institute and it is hoped that, as far as possible, visits will be made on these days. Appointments should be made for visits on other occasions.

### GUEST HOUSE

The Tea Research Institute Guest House is again available for visitors to the Institute. Applications for accommodation should be sent to the Director, T. R. I. St. Coombs, Talawakelle. Meals cannot be provided unless at least twenty-four hours' notice is given.



# The Tea Research Institute of Ceylon.

## BOARD OF CONTROL

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### (A) Representing the Planters' Association of Ceylon :—

- (1) Mr. R. C. Scott, C.B.E. (Chairman).
- (2) Mr. H. S. Hurst
- (3) Mr. W. W. A. Phillips.

### (B) Representing the Ceylon Estates Proprietary Association :—

- (4) Mr. J. C. Kelly (on leave) Mr. W. H. Gourlay (acting).
- (5) Mr. F. A. Bond (on leave) Mr. G. K. Newton (acting).
- (6) Mr. W. H. Attfield

### (C) Representing the Low-Country Products' Association :—

- (7) Mr. F. Amarasuriya

### (D) Representing the Small-Holders :—

- (8) Mr. S. Vytilingam, M.S.C.

### (E) Ex-Officio Members :—

- (9) The Hon. the Financial Secretary.
- (10) The Director of Agriculture.
- (11) The Chairman, Planters' Association of Ceylon.
- (12) The Chairman, Ceylon Estates Proprietary Association.

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Secretary, R. V. Norris, D.Sc., St. Coombs,, Talawakelle.



## CONTENTS.

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	Page
(1) Proceedings of the T. R. I. Conference ... ..	1
(2) Gadd, C. H.—The Institute During the War Years ...	3
(3) Eden, T.—Manurial Responses of Tea and Weeds and Discussion ... ..	5
(4) Tubbs, F. R.—Blister Blight and Discussion ...	9
(5) Gadd, C. H.—The Collection of Blistered Leaves ...	17
(6) T. R. I. Circular.—Recording the Incidence of Blister Blight. ... ..	20
(7) Tubbs, F. R.—Blister Blight ... ..	23
(8) ——— Minutes of Meetings of the Board of the Tea Research Institute of Ceylon held on 13-12-46 and 17-2-47	26

The publications of the Tea Research Institute will be sent, free of charge, to Superintendents of Ceylon tea estates, over 10 acres in extent, and to Estate Agencies dealing with Ceylon tea, if they register their names and addresses with the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle.

Other persons can obtain the publications of the Institute on application to the Director, the subscription being Rupees fifteen per annum for persons resident in Ceylon or India, and £1-5-0 for those resident elsewhere. Single numbers of *The Tea Quarterly* can be obtained for Rs. 2-50 or 4s. In the case of Indian cheques four annas should be added to cover commission.